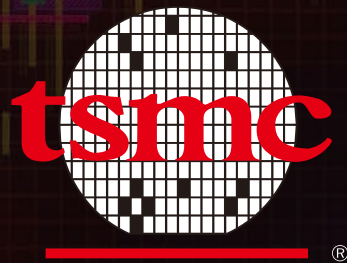


MIPI in Automotive Mixel



TSMC 2016
Open Innovation Platform®
Ecosystem Forum

ABSTRACT

As mobile platforms continue to proliferate and adoption of MIPI® accelerates, MIPI® is moving beyond the traditional mobile platform and into safety related applications, such as automotive applications. This is making testability and reliability of MIPI® PHY a key requirement.

While the D-PHY is the MIPI PHY with the widest adoption in the industry today, the RX+ is a D-PHY receiver configuration optimized for full-speed production testing. The presentation will give an overview of the use of MIPI in automotive applications, review testability challenges, examine the advantages of the RX+ configuration, and compare this configuration to traditionally used D-PHY configurations.

The Mixel MIPI RX+ IP is available in TSMC 40LP, 28HPM, and will soon be available in 16FFC.



MIPI in Automotive

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NXP, Thomas Wilson

NXP, Christian Tuschen

Agenda



- Why MIPI in Automotive?
- Information Flow in Auto & MIPI Usage
- Safety and Reliability
- D-PHY Optimized for Automotive
- D-PHY Universal Lane
- What is Mixel RX+ ?
- Success Stories
- Future Trends
- Q&A

Why MIPI in Automotive?



- What is similar
 - Need to use high resolution inexpensive cameras
 - Traditionally closed (vendor controlled) system interfaces
 - Historically using many non-standardized specifications
 - Low cost
 - High Volume
 - The “nervous system” is being connected both wired and wirelessly
 - Same capabilities are required: Collection, transmission, and processing of a wide variety of information at a wide range of speeds

Why MIPI in Automotive?



- What is different
 - Reliability and safety is paramount for automotive not as much for mobile
 - 1ppm vs. 100ppm field failure
 - Product life-cycle: tens of years, vs. a couple of years

Information Flow in Auto & MIPI Usage



- Telematics
 - Interfacing with GPS to navigation display
 - Includes touch and sound
- In-Vehicle Infotainment (IVI)
 - CSI
 - DSI
- Advanced Driver Assist Systems (ADAS)
 - CSI: Most prevalent MIPI usage
 - DSI
 - Lidar
 - Vision interfaces
 - Audio

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Information Flow in Auto & MIPI Usage



- Intelligent Transportation Systems (ITS)
 - Vehicle to infrastructure (V2I)
 - Vehicle to vehicle (V2V)
 - Vehicle to everything (V2X) connections:
 - ❑ connections, bridging to RF capabilities that support a number of different wireless (802.11p, ac, ah, Bluetooth) and cellular (LTE, GSM)
- Autonomous Driving Systems (ADS)

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Your Car's Sensor Shield

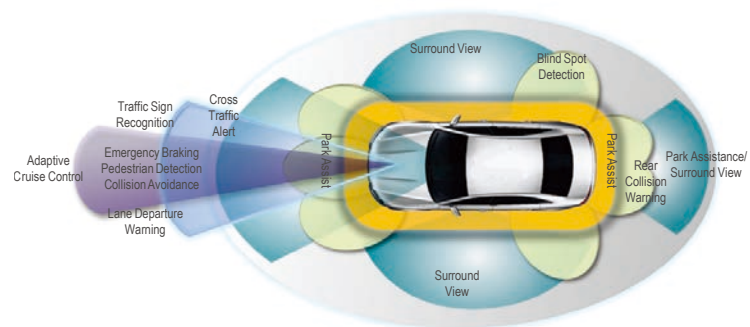


Figure 1: Courtesy of NXP

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Camera-to-Processor Connection

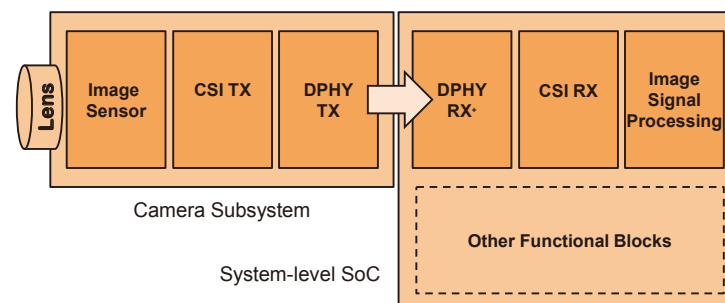


Figure 2

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Safety and Reliability



- Operational reliability and robustness are of paramount importance
 - ❑ 1ppm in field failure over tens of years
 - ❑ Wider range of temperature (-40C to 125C)
 - ❑ Wider range of process variation (5+ sigma)
- Rigorous and demanding reliability standards: AEC-Q100, IEC61508, and ISO26262
- Different grades of reliability
- Testability is key to insure continued safe operation
 - ❑ Full speed production testing
 - ❑ In-system test capability

D-PHY Optimized for Automotive



- Receiver usage is widely adopted on the chips receiving camera data stream
- RX+ is a D-PHY configuration that enables
 - Full-speed, full function, comprehensive
 - ❑ production test
 - ❑ in-system test
 - Supports higher data rates at lower BER
 - ❑ Lower capacitive load at serial interface
 - Small foot print
 - ❑ Area reduction: ~35 %
 - Lower inactive power
 - ❑ Leakage Power reduction: ~50 %

D-PHY Universal Lane

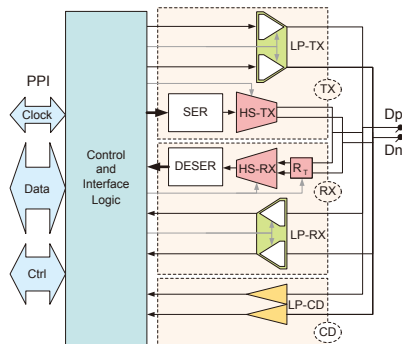


Figure 3

What is Mixel RX+ ?



The Mixel proprietary implementation of the MIPI D-PHY compliant RX+ configuration combines the small area, lower power, and improved performance of RX configuration with the testability and diagnostics that are possible with Universal name, the best of both.

Here is how we do that....

RX⁺ D-PHY Hard Macro

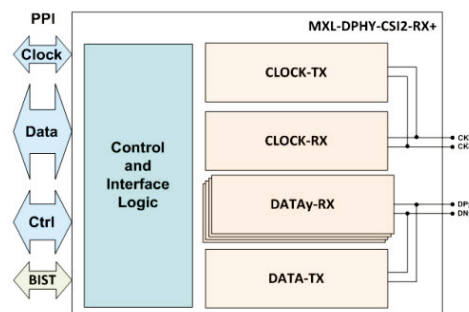


Figure 4

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Automotive Collaboration



- Mixel is collaborating with both TSMC and its automotive customers to meet the strict safety and reliability requirements
- TSMC ISO 9000A is being developed to address automotive and Mixel is supporting that effort
- RX+ configuration has been ported to multiple nodes at TSMC
 - Silicon-proven and in production at 40nm
 - Silicon-proven and going to production at 28nm
 - Being ported to 16FF

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Use Case: NXP S32V234

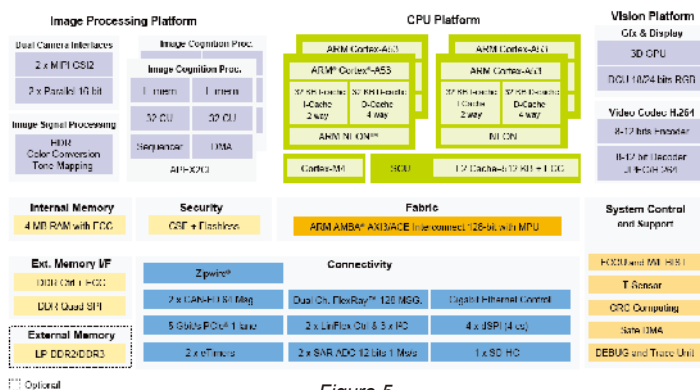


Figure 5

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NXP Use of Mixel IP



- The NXP S32V234 uses the Mixel RX+ in a CSI application
- It is an ADAS solution for vision, sensor fusion and surround view applications
- It integrates a quad-core ARM® Cortex®-A53 processor, NXP APEX™ Image Cognition Processor, Vivante GC3000 Processing Unit, and an advanced memory bus system architecture
- D-PHY operates at up to 1.5Gbps per Channel
- 6 Gbps aggregate bandwidth

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Success Stories



- TSMC 40nm is going to production on first silicon
- Customer's 28nm IC was demonstrated by customer within 2 weeks of the them receiving first silicon from TSMC
- Mixel continue to collaborate with it customers to provide its automotive MIPI customers with differentiated innovative solution that is specifically optimized for the demanding automotive requirements

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Future Trends



- Suppliers are moving to extend ADAS into ADS
- MIPI in evolving to support automotive requirements
 - Considering long reach channels
 - High-speed turn around
- Accelerating Radar use with MIPI as high-bandwidth transceiver interconnect with Radar Signal Processor
 - Key in Autonomous Driving Systems
- New players jumping into deployment
- Traditional players are accelerating their adoption
- Exiting future lies ahead for consumers and many opportunities for early adopters

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Conclusion



- The electronic content in automotive is increasing substantially
- Automotive electronics are increasingly adopting MIPI standards
- Mixel collaboration with both its automotive customer and TSMC, results a MIPI PHY configuration that is specifically optimizes for the demanding automotive environment
- The RX+ configuration is well optimized to meet the safety and reliability goals

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